**OBJECTIVES:** The objective of this study was to evaluate the frequency of long QT syndrome (LQTS) in the electrocardiographic tracing of elderly people and the concomitant use of drugs that can aggravate this condition. **METHODS:** This is a cross-sectional, observational study of elderly patients in outpatient services at Hospital Santa Casa de Misericórdia de Vitória, over a six-month period. **RESULTS:** A total of 163 patients with 75 ± 8 (60–94) years of age, 60.7% (n = 99) of whom were female, participated in the study. Of the total number of patients, 33.1% (n = 54) were regularly taking at least one pharmaceutical that increased the risk of QTc prolongation; 34 patients (20.9%) had prolonged QTc and 15 (9.2%) had at-risk QTc. Of these patients with at-risk QTc, 4 (23.4%) were using at least 1 pharmaceutical that increases the risk of QT prolongation (p = 0.07). **CONCLUSION:** In this sample, a high frequency of LQTS was observed, as well as the use of pharmaceuticals that potentially cause LQTS and arrhythmias. **KEYWORDS:** Long QT syndrome; Pharmaceutical preparations; Elderly people.

**RESUMO**

**OBJETIVOS:** O objetivo deste estudo foi avaliar a frequência de síndrome do intervalo QT longo (SQTL) no traçado eletrocardiográfico de pessoas idosas e o uso concomitante de fármacos que possam agravá-la. **MÉTODOS:** Trata-se de um estudo observacional, do tipo corte transversal, de pacientes idosos atendidos nos ambulatórios de especialidades do Hospital Santa Casa de Misericórdia de Vitória (ES), durante o período de seis meses. **RESULTADOS:** Participaram do estudo 163 pacientes com 75 ± 8 (60–94) anos de idade, 60,7% (n = 99) dos quais eram do sexo feminino. Do total de pacientes, 33,1% (n = 54) faziam uso regular de pelo menos um fármaco de risco para prolongamento de intervalo QT corrigido (QTc). Trinta e quatro pacientes (20,9%) apresentaram QTc longo e 15 (9,2%), QTc de risco. Dos pacientes com QTc de risco, 4 (23,4%) faziam uso de pelo menos 1 fármaco de risco para prolongamento do intervalo QT (p = 0,07). **CONCLUSÃO:** Nesta amostra, observou-se alta frequência de SQTL, bem como o uso de fármacos potencialmente causadores de SQTL e arritmias. **PALAVRAS-CHAVE:** síndrome do QT longo; preparações farmacêuticas; idoso.
INTRODUCTION

Conduction disorders and arrhythmia in electrocardiograms (ECG) in elderly people does not necessarily imply the occurrence of a pathological process, since aging can cause physiological changes to the heart, such as reduced conduction velocity through the atrioventricular node and longer refractory periods, thus prolonging the QT interval.1 Due to the incidence rate and the difficulty in therapeutic handling, ventricular arrhythmias are given special attention in geriatric medicine.2

Long QT syndrome (LQTS) can be congenital, caused by alterations in ion channels in cardiac cells, or acquired, induced by pharmaceuticals or electrolyte disorders. Regardless of the etiology, LQTS can bring about syncope or turn into ventricular fibrillation and torsades de pointes (Tdp), leading to sudden death.3

Pharmaceuticals that can cause the prolongation of the QT interval are common — 2 to 3% of all prescription medication is estimated to fall into this category, with antibiotics and psychotropic drugs being more commonly involved in the induction of LQTS.4

The elderly population is known for its chronic, concomitant use of various pharmaceuticals, known as polypharmacy (the continuous use of five or more drugs).5 Therefore, assessing the pharmaceuticals that interfere in cardiac conduction, as detected in ECGs through the prolongation of the QT interval, helps to guide the general practitioner, especially during primary care, in making decisions that can prevent cardiovascular events.2

METHODS

This was cross-sectional, observational study with elderly patients (> 60 years of age) treated in the multi-specialty ambulatory center at Hospital Santa Casa de Misericórdia de Vitória. Patients agreed to participate in the study after learning about its objectives and reading the Free Informed Consent Form, from January to July 2015.

The Bazett’s formula was used to assess the prolonged corrected QT interval (QTc) [QTc = QT found / √ (interval R–R)] in the ECG tracing. Long QTc intervals were considered to be ≥ 450 ms for men and ≥ 470 ms for women.6 A ≥ 500 ms QTc interval was considered at-risk for both sexes.7 The ECG tracing was conducted in the morning, during appointments in the multi-specialty outpatient center (general clinic, geriatric medicine, oncology clinic, gastroenterology, cardiology, endocrinology, neurology and rheumatology) at Hospital Santa Casa de Misericórdia de Vitória (ES), with the patient at rest for 10 minutes. Patients with atrial fibrillation, complete left bundle branch block and sinus bradycardia were excluded from the study. The pharmaceuticals under regular use were reported by the patient or family members and, later, by electronic medical record (MV).

Dependent variables associated with the long and at-risk QTc intervals were analyzed, as were the independent variables associated with the prolongation of the QT interval. The following variables were considered: gender, polypharmacy, hypothyroidism, typical and atypical neuroleptics, serotonin antagonists, diuretics, cardiovascular drugs and antiemetics.8

The independent variables with the power to induce the prolongation of the QTc interval were analyzed individually and as a group, with the purpose of increasing the power of association with the dependent variables, respectively. The variables were represented by the percentage and the mean with standard deviation (with a 95% confidence interval), when dichotomous and continuous, respectively. For the association analysis of the dichotomous variables, the χ² test (Fisher’s exact test) and adjusted and unadjusted logistic regression were used for gender and age (as a continuous variable).

The analysis was conducted using the Statistical Package for the Social Sciences (SPSS), version 22.0 (Series: 10101141221; License: fc48de7ce06356ade4c0). Values ≥ 0.05 were considered significant. The project was approved by the Human Research Ethics Committee at Escola Superior de Ciências from Santa Casa de Misericórdia de Vitória (CEP/EMESCAM) (CAAE: 15458613.8.0000.5065).

RESULTS

Over a period of six months, in 2015, 163 75-year-old (±8) patients were assessed, being 99 females (60.7%) and 24 with hypothyroidism (14.7%). Sixty-six patients (41.7%) used more than 5 pharmaceuticals (polypharmacy).

Of the patients studied, 34 (20.9%) had long QTc, and 15 (9.2%), at-risk QTc. Twelve patients (16%; p = 0.11) with an ECG tracing containing a long QTc and 4 patients (5.3%; p = 0.07) with at-risk QTc were using at least one medicine that could induce prolongation of the QT interval.

The frequency of the independent variables presented in patients with long QTc interval and at-risk QTc are represented in Tables 1 and 2.

The pharmaceuticals that induce the prolongation of the QT interval, and their summation as independent variables, both adjusted and unadjusted for gender and age, are represented in Table 3.
DISCUSSION

In the sample from this study, with subjects aged 75 (±8) years and predominantly female, 34 (20.9%) and 17 (10.4%) patients presented LQTS and at-risk QTc in their ECG tracing, respectively. Four patients (23.4%) who had an at-risk QTc interval regularly used at least one medication that induces the prolongation of the QT interval.

Physiological and acquired factors have been associated with long QT intervals and the risk of torsades de pointes; aging can increase the QT interval, and females present, on average, an increase of 20 ms when compared to males.9,10 In this sample, there was a predominance of females; however, this did not influence the alteration in the QTc interval.

Some authors suggest that before introducing pharmaceuticals related to the induced prolongation of the QT interval, especially high doses of medication or drug interactions, an ECG should be conducted before prescribing medication, and patients should be monitored after prescriptions, due to the risk of developing TdP in patients with a QTc over 500 ms.11,12

In a prospective study with 900 patients who had been admitted into a cardiac intensive care unit, researchers found that 50% of these patients presented a prolongation of the QT interval, with the frequent (42%) use of pharmaceuticals known to induce the prolongation of the QT interval during hospital stay.13

A small, yet important, portion of patients with at-risk QT interval were observed (9.2%; n = 15); of these, approximately one quarter used at-risk pharmaceuticals.

Among the at-risk drugs, antipsychotics and antidepressants are the most cited in the literature, with little emphasis on diuretics, about which few studies have been published.14 In Brazil, during a retrospective study with 161 patients, Claudio BQ et al. observed a dispersion of the QT interval that was significantly higher in the group using psychotropic

<table>
<thead>
<tr>
<th>Variable</th>
<th>Patients with normal QTc interval (n = 129) (%)</th>
<th>Patients with prolonged QTc interval (n = 34) (%)</th>
<th>p*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female sex</td>
<td></td>
<td></td>
<td>0.23</td>
</tr>
<tr>
<td>Hypothyroidism</td>
<td></td>
<td></td>
<td>0.20</td>
</tr>
<tr>
<td>Polypharmacy</td>
<td></td>
<td></td>
<td>0.44</td>
</tr>
<tr>
<td>Groupings (all groups)</td>
<td></td>
<td></td>
<td>0.52</td>
</tr>
</tbody>
</table>

*χ² test; QTc: corrected QT interval.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Patients with normal QTc interval (n = 148) (%)</th>
<th>Patients with normal QTc interval (n = 15) (%)</th>
<th>p*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female sex</td>
<td></td>
<td></td>
<td>0.27</td>
</tr>
<tr>
<td>Hypothyroidism</td>
<td></td>
<td></td>
<td>0.22</td>
</tr>
<tr>
<td>Polypharmacy</td>
<td></td>
<td></td>
<td>0.10</td>
</tr>
<tr>
<td>Groupings (all of the pharmaceuticals that induce risk)</td>
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<td></td>
<td>0.40</td>
</tr>
</tbody>
</table>

*χ² test; QTc: corrected QT interval.

<table>
<thead>
<tr>
<th>Grouped variables for the risk of developing prolonged QTc interval</th>
<th>Prolonged QTc (95%CI)</th>
<th>At-risk QTc (&gt; 0.500 ms) (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unadjusted</td>
<td>1.07 (0.45 – 2.52)</td>
<td>0.74 (0.23 – 2.30)</td>
</tr>
<tr>
<td>Adjusted for gender and age (continuous)</td>
<td>1.08 (0.46 – 2.55)</td>
<td>0.73 (0.23 – 2.31)</td>
</tr>
<tr>
<td>More than one variable for the risk of developing prolongation of QTc interval</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unadjusted</td>
<td>3.07 (0.38 – 24.72)</td>
<td>1.12 (0.13 – 9.36)</td>
</tr>
<tr>
<td>Adjusted for gender and age (continuous)</td>
<td>3.05 (0.38 – 24.53)</td>
<td>1.10 (0.13 – 9.27)</td>
</tr>
</tbody>
</table>

95%CI: 95% confidence interval; QTc: corrected QTc interval.
medication compared to the group of non-users (69.250 ± 25.500 ms versus 57.080 ± 23.400 ms; p = 0.002).15

Among the group of medications that induce the prolongation of the QT interval, the most frequent in the sample from the present study are the diuretics, the serotonin antagonists and the atypical neuroleptics. However, when grouped as independent variables, or when assessed as a summation of more than one pharmaceutical, no statistical association was found with the prolongation of the QTc interval.

Among the at-risk conditions for the prolongation of the QT interval are the female gender, hypothyroidism and polypharmacy, in addition to the aging process,13,14 with no statistical significance in this study.

One of the limitations found in this study is a single ECG tracing done after the clinical appointment in the multi-specialty outpatient care, without the possibility of identifying electrolyte alterations, which are common in the use of the employed pharmaceuticals (diuretics, neuroleptics and antidepressants).

This study, despite identifying a frequency of 20.9% (LQTS) and 9.2% (at-risk QTc) among the elderly treated in outpatient care, did not observe a statistically significant association with other risk factors mentioned in the literature.

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CONFLICTS OF INTEREST

The authors declare there is no conflict of interest.

REFERENCES